when about 300 miles from San Francisco. He was promptly picked up. Commander Rodgers was less fortunate. When approaching the Hawaiian Islands, after some 1,800 miles of flight, his gas supply gave out and he was compelled to land. Although the plane was in communication by radio with the patrol ship *Aroostook* until nearly the moment of her descent, efforts to locate her were unavailing. All surface craft which the Navy could assemble in those waters engaged in the search. Nine days later, at 4 p. m., September 10, after hope of effecting a rescue had been practically abandoned, the plane and all her crew were picked up by the submarine *R–4*, 15 miles east of the island of Kauai.

During the interim between the time of the plane's disappearance and her discovery various theories were advanced to account for the failure to locate her. It was naturally assumed that she had foundered, and attempts were made to attribute the catastrophe to the prevalence of foul weather in the vicinity of the islands at the time she went down. In many cases newspaper accounts exploited this possibility with the tone of assurance, assuming that she was buffeted by wind and sea, and sank immediately. In fact, this impression seemed to become so widely current that the Weather Bureau issued to the press statements testifying to the nonexistence of abnormal weather conditions during the time the plane was in flight and for several days after she came down. The weather charts on which this contention was based are reproduced in Figure 2 to show the wind, weather, and pressure situation over the Pacific Ocean between the Pacific coast of North America and the one hundred and seventieth meridian, west longitude. They include the period from the morning of August 31 to the evening of September 1, the entire interval of flight. They are practically replicas, on small scale, so far as the situation at sea is concerned, of the synoptic charts for that period prepared in the San Francisco office of the Weather Bureau, on the basis of radiographic weather reports from ships in the North Pacific Ocean, the observations being made at 7 a. m. and 7 p. m., seventy-fifth meridian time. These observations do not, it will be observed, imply the existence of abnormal weather conditions in the area of the Hawaiian Islands at any time during the period.

The symbols employed are the usual ones to indicate wind direction and state of weather. An unfilled circle indicates clear weather at the time of observation, a half-filled circle partly cloudy weather, and a filled circle cloudy weather. Arrows fly in the direction in which the wind is reported as blowing. The velocity of the wind as estimated by the observer is given in miles per hour at the point of the arrow. Where no arrow is shown the weather is understood to be calm.

While the concluding chart of the series, that for the evening of September 1, indicates a moderate depression some distance off the southern California coast, conditions everywhere west of longitude 145° are of the type that might be expected to prevail there over the greater part of the summer. Cloudiness is neither extensive nor of an unusual character, while winds as regards both direction and force are normal.

The evening report from the U. S. S. *Langley* on September 1 incorporated the following additional data, obtained from pilot balloon observations, exhibiting the movement of the wind aloft:

Altitude (feet)	Wind direction	Velocity, miles per hour
Surface.	NE	10
1,000	NE	16
2,000	NE	13
3,000	NE	12
4,000	NE	12

The *Langley's* position, in approximately latitude 26° N., longitude 146° W., while not close to the point at which Commander Rodgers was forced down, was nevertheless not so remote as to render free-air data inapplicable, and her observations serve to confirm the inferences drawn from surface data throughout the area as to the nonexistence of any abnormal tendencies either local or widespread west of longitude 145°.

It is a pleasure to record the cordiality of cooperation between the Weather Bureau and the Navy Department in the transactions incident to the west coast-Hawaiian flight. The following letter to the official in charge at the San Francisco office of the Weather Bureau from Capt. Stanford E. Moses, United States Navy, commander, aircraft squadrons, Battle Fleet, who was designated to act as project commander for the flight, bears significant testimony thereto:

> I want to thank you and your assistants at the Weather Bureau for their kindness and splendid cooperation with us in connection with the west coast-Hawaiian seaplane flight.
>
> Your work was excellent and your long knowledge of weather conditions was of great help to us.

A FURTHER STUDY OF THE RELATION BETWEEN COVER CROPS AND ORCHARD TEMPERATURES

By FLOYD D. YOUNG

[Weather Bureau office, Los Angeles, Calif., September 29, 1925]

For a number of years many citrus growers in southern California have believed that the presence of a cover crop in an orchard lowers the temperature several degrees on a frosty night. As a result, the growing of winter cover crops has been abandoned in many citrus groves where this practice is quite necessary to maintain the fertility of the soil. Shortage of irrigation water prevents the growing of summer cover crops in most districts.

The Weather Bureau carried on experimental work at Pomona during the winter of 1921–22, to determine just what influence a cover crop has on the temperature on frosty nights. A complete report on this work was published in the MONTHLY WEATHER REVIEW.[1]

It was found that the air temperature was depressed only 0.1° F. at a height of 5 feet above the ground, and 1.0° F. at a height of 10 inches above the ground, due to the presence of a cover crop. Since there usually is little fruit near the ground, the temperature differences found should have little effect on the amount of damage to the fruit.

Observations made with unsheltered thermometers, at heights of 24 inches and 7 inches, respectively, showed that the minimum temperature was lowered 0.4° F. at the 24-inch elevation and 2.4° F. at the 7-inch elevation, due to the presence of the cover crop. Temporary temperature differences in the earlier part of the night as great as 8.7° F. at the 24-inch elevation, and 11.0° F. at the 7-inch elevation, were observed. These large differences

[1] Young, Floyd D.: Influence of Cover Crops on Orchard Temperatures. MONTHLY WEATHER REVIEW, October, 1922, 50 : 521-526.

were thought to be due to wind, which mixed the colder surface air strata with the warmer strata at slightly higher levels, the effect reaching down to the ground in the clean cultivated area, but not penetrating much below the tops of the cover crop plants because the cover crop acted as a windbreak on a small scale. During the entire period covered by the experiment the ground in the orchard was very damp, and often was wet and muddy. The area of the orchard used in the 1922 experiment was only 6 acres. It was thought that a larger area in cover crops might lower the temperature to a greater degree.

During the fall of 1923, a 10-acre orange grove near Claremont, Calif., was selected for the continuation of the experiment. The grove selected was almost ideally located for the test. It was practically level, with mature Navel and Valencia orange trees set 20 feet apart, on the square. The cover crop consisted of purple vetch, planted 40 pounds to the acre, a heavy volunteer crop of Broad Windsor horse beans, and many high weeds. The soil was a rich black loam. The grove was kept well irrigated, and the cover crop made a luxuriant growth. The entire grove was in cover crop when the experiment was begun. The rainfall during the winter was unusually light, and the ground in the orchard was dry during the greater part of the time, except immediately following irrigations.

The same plan of operation was followed in this experiment as in the former one at Pomona. The grove was divided into two 5-acre plots designated as "east" and "west" plot, respectively, and temperature stations were placed near the center of each.

The instrumental equipment and exposure of instruments were the same at both stations. (Fig. 1.) Fruit-region instrument shelters, containing maximum and minimum thermometers, and 29-hour thermographs were installed on supports so that the thermometers were 5 feet above the ground. Fruit-region shelters, containing the same instrumental equipment, were set directly on the ground, the thermometers being 10 inches above the ground.

After the stations had been established 10 clear, frosty nights were allowed to pass with the entire grove still in cover crop, in order to establish a definite temperature relation between the two plots. The minimum temperatures registered in both plots on these nights are given in Table 1. Temperatures averaged 0.1° F. lower at the 5-foot elevation and 0.2° F. lower at the 10-inch elevation in the west plot than in the east plot during this period.

East plot cover crop removed.—On January 4, 1924, the cover crop in the east plot was plowed under,[2] and the ground was cultivated so thoroughly that hardly a trace of the cover-crop plants remained on the surface of the ground. (See fig. 2.) The cover crop in the west plot was not disturbed. If the cover crop had been exerting a marked influence on the temperature, the east plot, now clean cultivated, should be considerably warmer than the west plot, still in cover crop.

After the cover crop in the east plot was removed temperature records were obtained covering 24 frosty nights. Minimum temperatures recorded at the two elevations in both plots each night during this period are shown in Table 2.

It will be noted that the average difference in minimum temperature between the two plots is only 0.6° at the 5-foot elevation and 1.5° at the 10-inch elevation. Comparing these differences with the average differences between the two plots before the cover crop was removed from the east plot, it will be seen that the cover crop lowered the minimum temperature 0.5° at the 5-foot elevation and 1.3° at the 10-inch elevation. We might assume from these figures that the temperature was lowered about 1° at a height of 3 feet above the ground. On a night when the temperature barely falls to the danger point in a clean cultivated grove this difference of 1° might account for considerably more damage to fruit in the lower portion of the trees in an orchard with a cover crop.

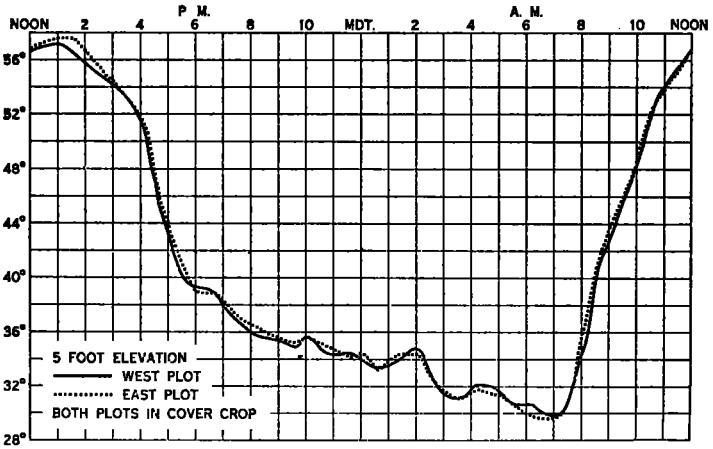

FIG. 3.—Average semihourly temperatures during eight clear, frosty nights, at east and west experimental plots, while the entire grove was still in cover crop. (Sheltered thermometers, 5 feet above the ground.) This figure shows the normal relation between the temperature in the two plots, and is to be used as a check for Figure 4

In order to have a complete record of the influence of the cover crop on the temperature throughout the day and night semihourly temperatures for the whole 24 hours on each of the 19 days on which frost occurred after the cover crop was removed from the east plot

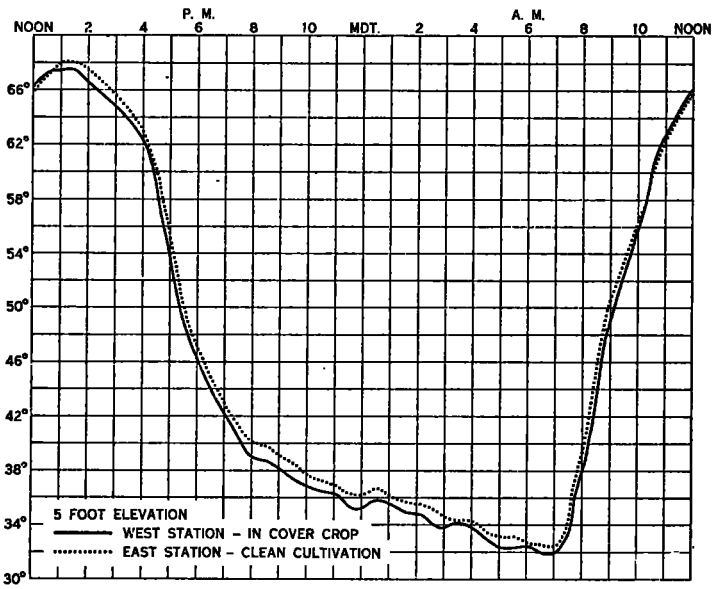

FIG. 4.—Average semihourly temperatures during 19 clear, frosty nights, at east and west experimental plots, after the cover crop in the east plot had been plowed under. The west plot is still in cover crop. (Sheltered thermometers, 5 feet above the ground.) A comparison between Figures 3 and 4 shows the effect of the cover crop on the temperature at this elevation

were averaged and plotted. The same data were secured for 8 days while both plots were in cover crop, to show the normal relation between the daily march in temperature at the two stations. As 29-hour thermographs were used, and the records were checked frequently on cold nights, both as to time and temperature, it was possible

[2] The writer wishes to express his appreciation for the action of the Ontario-Cucamonga Fruit Exchange and the Pomona Valley Orchard Protection Association in paying the expense of plowing under the cover crop in the 5-acre plot during the 1923–24 experiment.

(To face p. 388)

FIG. 1.—West experimental plot, showing instrument shelters and growth of cover crop. [The stand of cover crop on the east plot was so closely similar to that on the west that no view of it is presented]

FIG. 2.—East experimental plot after removal of cover crop

to calculate these semihourly temperatures to tenths of a degree with considerable accuracy.

The average semihourly temperatures for the 5-foot shelters at the east and west stations during the period while the entire grove was still in cover crop are shown in Figure 3. The same data for the period after the cover crop had been removed from the east plot are shown in Figure 4. These diagrams show that the temperature was lowered about 0.5° F. at the 5-foot elevation throughout the period from 6 p. m. to 10 a. m.

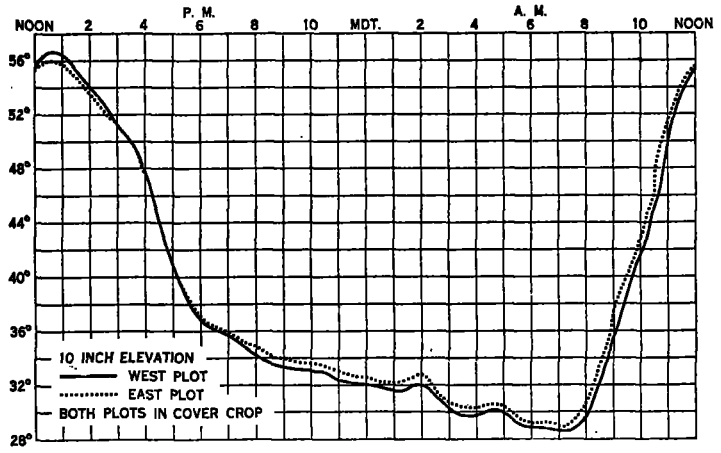

FIG. 5.—Average semihourly temperatures during eight clear, frosty nights, at east and west experimental plots, while the entire grove was still in cover crop. (Sheltered thermometers, 10 inches above the ground.) This figure shows the normal relation between the temperature in the two plots. This diagram is to be used as a check for Figure 6

The effect of the cover crop was considerably greater at the 10-inch elevation. A comparison of Figures 5 and 6, which show the difference in temperature at this elevation before and after the cover crop was removed

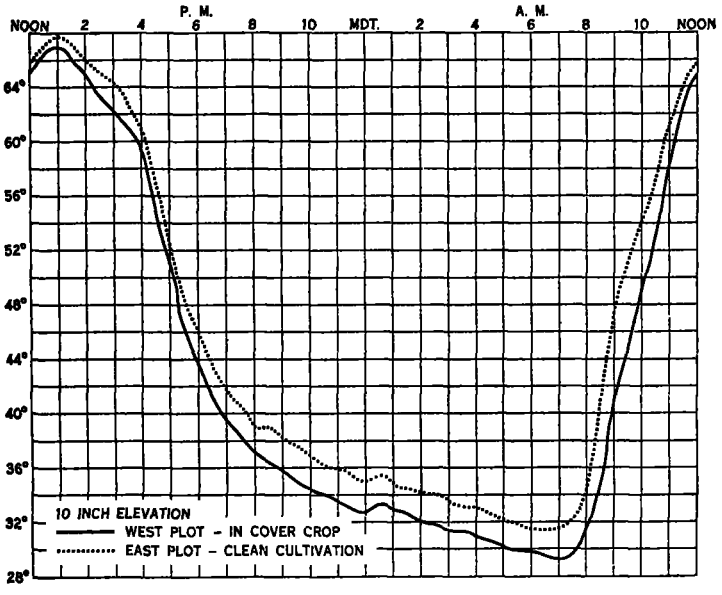

FIG. 6.—Average semihourly temperatures during 19 clear, frosty nights, at east and west experimental plots, after the cover crop in the east plot had been removed. The west plot is still in cover crop. (Sheltered thermometers, 10 inches above the ground.) A comparison between Figures 5 and 6 shows the effect of the cover crop on the temperature at this elevation

from the east plot, brings out this point. Figure 6 shows that the temperature in the cover-crop plot was lower than in the clean cultivated plot both day and night. The fall in temperature during the evening was earlier and the morning rise in temperature was delayed in the cover-crop plot. During the period from 6 p. m. to 8 a. m. the temperature in the cover-crop plot was depressed from 1° to 2°. During the period from 8 a. m. to 11 a. m., while the temperature was rising rapidly, the lag in the rise in temperature in the cover-crop plot was sometimes as much as 4°.

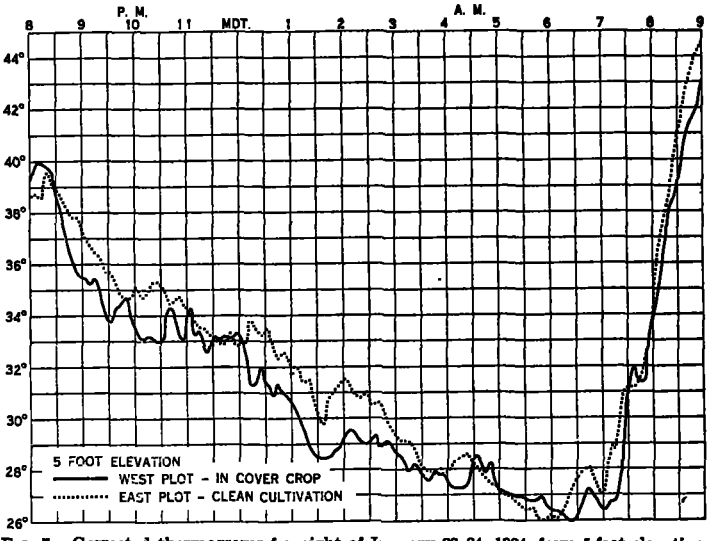

FIG. 7.—Corrected thermograms for night of January 23-24, 1924, from 5-foot elevation sheltered thermometers in east plot (clean cultivation) and west plot (in cover crop) showing effect of the cover crop on the temperature. See Figure 3 for normal relation between temperature in the two plots

In Figure 7 are shown corrected thermograms for the east and west 5-foot stations for the night of January 23–24, 1924, the coldest night which occurred after the cover crop was removed from the east plot. A comparison of Figure 7 with Figure 3 shows the effect of the cover crop on the temperature at the 5-foot level on this night.

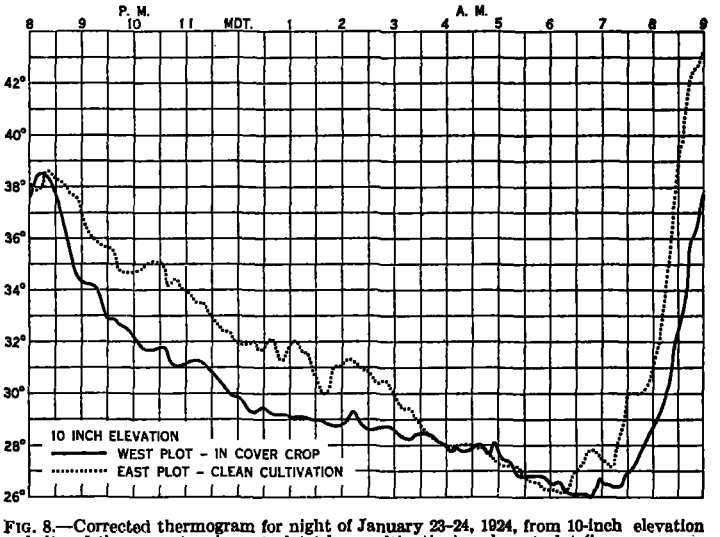

FIG. 8.—Corrected thermogram for night of January 23-24, 1924, from 10-inch elevation sheltered thermometers in east plot (clean cultivation) and west plot (in cover crop), showing effect of the cover crop on the temperature. See Figure 5 for normal relation between the temperatures in the two plots. From the character of the record it is evident that the lower temperature in the cover crop area during the earlier part of the night is due to the greater mixing effect of the wind in the clean cultivated plot

Corrected thermograms for the same night, January 23–24, at the 10-inch elevation in both the east and west plots, are shown in Figure 8. They should be compared with Figure 5, which shows the normal relation between the two plots while both were still in cover crop. Note the greater fluctuations in temperature in Figure 7 as compared with Figure 8, due to the mixing of the air

strata of different temperatures by light winds at the 5-foot elevation, which were not felt at the 10-inch elevation. The records for this night, both at the 5-foot and the 10-inch elevation, show an unusually large difference in temperature between the plot in cover crop and that in clean cultivation during the early part of the night. At the 10-inch elevation there was more than 3° difference in temperature between the two plots at times.

It is believed that these temporary differences in temperature were due to a light wind in the orchard, which affected the temperature to a greater extent in the clean cultivated plot than in the plot in cover crop, owing to the windbreak effect of the cover crop. When the wind died out about 3 a.m. the temperature in the clean cultivated area fell rapidly until it came into agreement with the temperature in the cover-crop area. The minimum temperatures in the two plots were practically the same. Figures 7 and 8 tend to confirm the conclusions reached following the 1922 experiment, that the large temperature differences between groves in cover crop and those clean cultivated, observed by fruit growers, are due to the different effects of light winds.

Observations with unsheltered thermometers.—Unsheltered minimum thermometers were exposed on posts, at heights of 5 feet and 2 feet, respectively, above the ground at the stations in the east and west experimental plots. Minimum temperatures registered by these thermometers during 10 clear, frosty nights before the east plot was plowed, and during 24 clear, frosty nights afterward, are given in Table 3. The average depression of the minimum temperature due to the presence of the cover crop, as shown by these unsheltered thermometers, was 0.5° at the 5-foot elevation and 1.1° at the 2-foot elevation.

Current temperature readings of the unsheltered thermometers made during cold nights, before and after the cover crop in the east plot was plowed under, are shown in Table 4. During the 1922 experiment large temporary differences in temperature between the cover crop and clean cultivated plots were noted during the earlier part of the night. It was believed these differences were due to light winds, which raised the temperature in the clean cultivated plot. No large temperature differences of this kind were noted during the latest experiment, due, it is believed, to the fact that the grove was well sheltered.

Because of the fact that the winter of 1923–24 was unusually dry, moisture was seldom deposited on any of the exposed thermometers. During the progress of the first experiment, in 1921–22, the lower exposed thermometers, especially in the cover-crop plot, were covered with water, ice, or frost on most clear nights.

ACTUAL DAMAGE RECORDS

Estimates made soon after a cold night, which indicate increased damage to fruit in orchards with cover crops, often have not been borne out by the packing-house records when the fruit was picked. Soon after the cold weather of early January, 1924, the manager of a packing house, who was firmly convinced that cover crops greatly increased the frost damage, made a careful estimate of the amount of damaged fruit in his district. He concluded that the damage had been much greater in orchards containing cover crops. However, later examinations made in the presence of the writer failed to confirm this belief.

An unusually close examination of the fruit from three adjoining orchards, on almost level ground, was made at the time the fruit was picked, to determine the amount of frost injury. The final record was as follows:

Grove No. 1, clean cultivation.—This grove contained the largest amount of frost-damaged fruit of the three groves considered. When picking was begun in the district, this grove showed so large a percentage of damaged fruit, as indicated by the presence of hesperidin crystals, that picking had to be stopped, and was postponed until near the end of the season, when much of the fruit had recovered.

Grove No. 2 (adjoining No. 1 on the north), in vetch cover crop.—See table below.

Grove No. 3 (adjoining No. 2 on the north), in vetch cover crop.—See table below.

The grade records for the three groves are given below.

Grove	Extra choice	Choice	Culls
	Per cent	*Per cent*	*Per cent*
No. 1	78.9	13.3	7.8
No. 2	79.4	11.1	9.5
No. 3	80.7	12.5	6.8

In this case the apparently increased amount of frost damage due to the presence of a cover crop in the grove was not verified by the actual damage records.

CONCLUSIONS

The results obtained from this experiment confirm in almost every detail the conclusions drawn from the experimental work carried on during the winter of 1921–22. The depression of the temperature due to the presence of the cover crop was somewhat greater in the latest experiment, but this was to be expected, since the area in cover crops was larger.

It is believed that the results obtained in the two experiments, conducted in different orchards and during two frost seasons, are reasonably conclusive, since they agree closely. Cover crops do increase the frost hazard, but only to a slight extent. In many cases the increased damage in presence of a cover crop is probably due to the fact that the grove is on lower ground, where the temperature is naturally lower. In other cases the increase may be accounted for by the small temperature differences which have been found in the experimental work.

Actual differences in the amount of damage between clean cultivated groves and those in cover crops, which can not be explained by the differences in temperature found in the two experiments, must be attributed to some other influence than temperature, such as decreased vigor of the tree, due to competition from the cover crop, a less dormant condition of the trees caused by more frequent irrigations, or increased deposit of moisture on the fruit and foliage from dew or frost, when a cover crop is present in the orchard.

From a study of all the experimental data it appears that the difference in temperature between a clean cultivated citrus grove and one in cover crop, especially during the earlier part of the night, is largely due to the

cover crop acting as a windbreak, allowing the cold air to accumulate near the ground, and preventing it from mixing with the warmer air above.

The condition of the surface soil with regard to moisture content was radically different during the two seasons when the experimental work with cover crops was in progress. During the winter of 1921–22 the ground was wet throughout the season, while it was unusually dry throughout the 1923–24 season. The results obtained should therefore be indicative of all seasons, whether wet or dry.

TABLE 1.—*Minimum temperatures on frosty nights (sheltered thermometers)*

ENTIRE GROVE STILL IN COVER CROP

Date	5-foot elevation		Difference	10-inch elevation		Difference
	East plot	West plot		East plot	West plot	
Dec. 18	35.2	35.0	−0.2	34.0	33.9	−0.1
Dec. 20	30.2	30.2	.0	30.6	30.5	−.1
Dec. 21	29.3	28.7	−.6	29.7	29.0	−.7
Dec. 22	29.5	29.8	+.3	29.0	28.9	−.1
Dec. 23	32.0	32.2	+.2	29.7	29.7	.0
Dec. 25	34.0	34.0	.0	31.1	31.0	−.1
Dec. 31	29.5	29.3	−.2	30.0	29.7	−.3
Jan. 1	30.1	30.4	+.3	31.0	30.2	−.8
Jan. 2 [1]	22.6	22.8	+.2	23.0	22.7	−.3
Jan. 3 [2]	26.4	26.1	−.3	26.1	25.9	−.2
Average	29.9	29.8	−.1	29.4	29.2	−.2

[1] 11:55 a. m., ground unfrozen under cover crop; frozen where bare; frost in the shade; cover crop wet; cover crop plants badly wilted and lying on ground.
[2] 10:20 a. m., ground unfrozen under cover crop, but frozen hard where bare; tender foliage on orange trees killed. Frost still on ground and vegetation in the shade.

TABLE 2.—*Minimum temperatures on frosty nights (sheltered thermometers)*

EAST PLOT, CLEAN CULTIVATION; WEST PLOT IN COVER CROP

Date	5-foot elevation		Difference	10-inch elevation		Difference
	East plot	West plot		East plot	West plot	
Jan. 4	33.9	33.1	−0.8	33.0	31.3	−1.7
Jan. 5	32.9	32.3	−.6	31.2	29.7	−1.5
Jan. 6	31.0	30.3	−.7	30.2	28.6	−1.6
Jan. 7	34.2	33.9	−.3	33.0	30.8	−2.2
Jan. 8	30.0	29.5	−.5	29.3	28.7	−.6
Jan. 9	30.6	30.1	−.5	30.3	29.7	−.6
Jan. 10	34.4	33.9	−.5	33.4	31.7	−1.7
Jan. 11	33.0	32.8	−.2	32.2	30.0	−2.2
Jan. 12	33.2	32.3	−.9	32.3	30.3	−2.0
Jan. 13	29.5	27.9	−1.6	29.0	27.3	−1.7
Jan. 14	32.3	32.4	+.1	31.4	30.3	−1.1
Jan. 15	33.5	33.7	+.2	32.1	29.9	−2.2
Jan. 16	31.0	29.5	−1.5	30.3	28.9	−1.4
Jan. 17	31.0	31.0	0	30.2	29.0	−1.2
Jan. 18	29.7	29.7	0	29.3	29.0	−.3
Jan. 19	29.9	29.7	−.2	29.2	28.5	−.7
Jan. 20	31.1	29.7	−1.4	29.9	27.9	−2.0
Jan. 21	29.7	28.2	−1.5	29.1	26.4	−2.7
Jan. 22	31.7	30.1	−1.6	30.9	28.4	−2.5
Jan. 23	30.8	30.7	−.1	30.1	29.0	−1.1
Jan. 24	26.0	26.0	0	26.2	26.0	−.2
Jan. 25	29.8	29.6	−.2	29.9	28.8	−1.1
Jan. 26	33.1	33.4	+.3	32.0	30.1	−1.9
Jan. 27	35.9	33.3	−2.6	34.7	32.9	−1.8
Average	31.6	31.0	−.6	30.8	29.3	−1.5

TABLE 3.—*Minimum temperatures on frosty nights (unsheltered thermometers)*

ENTIRE GROVE STILL IN COVER CROP

Date	5-foot elevation		Difference	2-foot elevation		Difference
	East plot	West plot		East plot	West plot	
Dec. 18	33.9	34.0	+0.1	33.1	33.8	+0.7
Dec. 20	28.9	29.0	+.1	28.7	29.7	+1.0
Dec. 21	28.1	27.3	−.8	28.3	27.9	−.4
Dec. 22	28.0	28.9	+.9	27.5	28.8	+1.3
Dec. 23	30.7	31.3	+.6	29.7	29.7	0
Dec. 25	32.9	32.9	0	31.1	32.0	+.9
Dec. 31	27.9	28.0	+.1	28.0	28.9	+.9
Jan. 1	28.8	28.9	+.1	28.8	29.5	+.7
Jan. 2	21.0	21.3	+.3	21.0	22.0	+1.0
Jan. 3	25.4	25.3	−.1	25.0	25.7	+.7
Average	28.6	28.7	+.1	28.1	28.8	+.7

EAST PLOT CLEAN CULTIVATION; WEST PLOT IN COVER CROP

Jan. 4	32.5	32.2	−.3	32.3	32.0	−0.3
Jan. 5	31.1	31.1	0	30.2	30.4	+.2
Jan. 6	30.0	29.5	−.5	30.3	29.1	−1.2
Jan. 7	33.5	32.4	−1.1	32.7	31.9	−.8
Jan. 8	28.9	29.2	+.3	28.5	28.5	0
Jan. 9	29.7	29.1	−.6	29.6	29.5	−.1
Jan. 10	33.3	33.0	−.3	33.0	32.4	−.6
Jan. 11	31.8	31.5	−.3	31.4	30.9	−.5
Jan. 12	31.2	31.1	−.1	31.0	30.9	−.1
Jan. 13	28.3	27.2	−1.1	28.2	27.2	−1.0
Jan. 14	31.1	31.3	+.2	30.7	30.9	+.2
Jan. 15	32.0	32.0	0	31.2	31.3	+.1
Jan. 16	29.8	28.9	−.9	29.6	28.9	−.7
Jan. 17	30.0	30.1	+.1	29.7	29.4	−.3
Jan. 18	28.7	28.4	−.3	28.3	28.4	+.1
Jan. 19	28.4	28.3	−.1	28.0	28.1	+.1
Jan. 20	29.8	28.8	−1.0	29.0	27.9	−1.1
Jan. 21	28.1	27.1	−1.0	28.0	26.9	−1.1
Jan. 22	30.4	29.3	−1.1	30.0	28.9	−1.1
Jan. 23	29.7	29.4	−.3	29.3	29.1	−.2
Jan. 24	25.0	25.1	+.1	24.9	25.3	+.4
Jan. 25	28.8	28.2	−.6	28.7	28.4	−.3
Jan. 26	32.1	32.0	−.1	31.6	31.6	0
Jan. 27	34.1	32.8	−1.3	34.0	32.6	−1.4
Average	30.3	29.9	−.4	30.0	29.6	−.4

TABLE 4.—*Current temperatures (unsheltered thermometers)*

ENTIRE GROVE STILL IN COVER CROP

Date	Time	5-foot elevation		Difference	2-foot elevation		Difference
		East plot	West plot		East plot	West plot	
Dec. 20	5:45 p. m.	39.3	39.4	+0.1	38.3	38.9	+0.6
Dec. 21	8:40 p. m.	34.7	35.4	+.7	33.9	34.9	+1.0
Dec. 22	8:55 p. m.	34.0	34.0	0	32.0	33.0	+1.0
Dec. 23	3:00 a. m.	33.2	34.6	+1.4	31.3	32.9	+1.6
Jan. 1	9:20 p. m.	26.0	25.9	−.1	25.4	26.0	+.6
Jan. 2	3:30 a. m. [1]	22.9	24.3	+1.4	22.7	23.8	+1.1
Jan. 2	9:30 p. m.	28.9	28.8	−.1	28.0	28.4	+.4

EAST PLOT CLEAN CULTIVATION; WEST PLOT IN COVER CROP

Jan. 5	9:25 p. m.	37.7	35.6	−2.1	37.0	34.7	−2.3
Jan. 6	10:42 p. m.	37.9	37.9	0	37.1	37.0	−.1
Jan. 8	10:45 p. m.	40.0	37.5	−2.5	39.4	37.4	−2.0
Jan. 9	11:15 p. m.	36.1	36.6	+.5	35.6	34.3	−1.3
Jan. 10	12:05 a. m.	38.1	36.0	−2.1	37.2	35.1	−2.1
Jan. 10	1:05 a. m.	37.0	37.3	+.3	36.5	36.3	−.2
Jan. 10	2:00 a. m.	37.9	38.0	+.1	37.2	37.3	+.1
Jan. 10	4:00 a. m.	38.0	36.7	−1.3	37.3	35.9	−1.4
Jan. 10	5:00 a. m.	35.8	35.9	+.1	35.4	35.0	−.4
Jan. 10	6:00 a. m.	35.0	34.8	−.2	34.5	34.0	−.5
Jan. 17	8:45 p. m.	36.7	36.2	−.5	36.1	35.6	−.5
Jan. 17	10:00 p. m.	35.0	34.2	−.8	34.6	33.7	−.9
Jan. 17	11:25 p. m.	34.9	36.0	+1.1	34.5	35.0	+.5
Jan. 18	5:00 a. m.	29.6	31.0	+1.4	29.0	29.9	+.9
Jan. 23	9:05 p. m.	35.8	35.0	−.8	35.5	34.9	−.6
Jan. 25	5:40 a. m.	29.6	28.8	−.8	29.3	28.7	−.6

[1] Vegetation on ground frozen stiff. All plants wilted; some brittle. No frost on thermometers. Ground not frozen under cover crop, but frozen hard where bare.